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ABSTRACT

In response to interest from the Higher Education Advisory Council and a mandate from the 1985 Minnesota Legislature, Higher Education Coordinating Board staff conducted a project with three major goals: (1) to assess and report on the uses of information technologies in Minnesota postsecondary education; (2) to initiate collaborative activities to share information and resources among systems; and (3) to provide opportunities for policymakers to review issues for policy development. The term information technologies was used to include all video, audio, and computer technologies used for instruction. The project included a survey of Minnesota's postsecondary institutions; discussion with informed persons on campuses, at system offices, state agencies, corporations, and state and national organizations; and a review of the pertinent literature. Analyses of the data indicate that the use of technology for instruction is at an early stage of development. The technologies are new to most potential users, and the capacity of the hardware (computers in particular) has far outpaced the availability of appropriate courseware for instruction. The use of information technology, however, is beginning to increase rapidly and will involve changes in instructional content, sequencing, and methodology. Students will have opportunities for more self-directed learning. During this period of change, it is recommended that the state encourage, support, and recognize efforts by systems and institutions to experiment with and develop new uses of information technology. This report provides background information and an executive summary as well as a detailed report of project activities and findings, with emphasis on the importance of information technology to the state's postsecondary education; the use of computer, video, and audio technologies in instruction; obstacles and issues involved in using these technologies; and implications for state policy. Seven recommendations resulting from the study are also presented together with statements of the rationale and impact of each. A glossary of terms, an outline of the requirements for funding a computer infrastructure in higher education, and a copy of the survey questionnaire are appended. (BBM)

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Information Technology in Instruction in Minnesota Post-Secondary Education Institutions With Coordinating Board Recommendations

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Information Technology in Instruction in Minnesota Post-Secondary Education Institutions With Coordinating Board Recommendations

Minnesota Higher Education Coordinating Board
November 20, 1986

SUBJECT: INFORMATION TECHNOLOGY IN INSTRUCTION IN MINNESOTA POST-SECONDARY EDUCATION

DATE: NOVEMBER 20, 1986

ACTION: THE HIGHER EDUCATION COORDINATING BOARD RECOMMENDED THAT

1. The state provide financial incentives to systems and institutions to develop plans for the integration of information technologies into their instruction in ways consistent with their missions, resources, and priorities.

2. The state develop regional infrastructures to support institution and faculty sharing of resources and expertise in use of information technology.

2a. Each regional center also serve as a state resource center in a special need area.

3. The Coordinating Board continue its initiative to coordinate state policy development and provide leadership and assistance to effectively use information technology in post-secondary education.

4. The Coordinating Board continue to monitor instruction being offered in Minnesota by telecommunication from outside the state.

5. The systems instruct their institutions to review policies or establish policies that protect the intellectual property rights of courseware creators and transmission.

6. The Coordinating Board initiate actions with the Minnesota Department of Administration to review need and opportunities for post-secondary education systems and state agencies to collaborate in increasing the capacity of the state's electronic transmission network(s).

7. The Coordinating Board instruct its executive director to work with HEAC members to determine if proposals by their system to expand post-secondary use of new information technologies in instruction and research can be combined into a single legislative initiative with broad-based post-secondary education support.

OVERVIEW OF COORDINATING BOARD RECOMMENDATIONS

Background and Rationale

The rapid proliferation of information technologies--which include all video, audio, and computer technologies--has accentuated the need for a systematic gathering, assessment, and dissemination of information about these technologies and their impact on post-secondary eucation policy.

In response to interest from the Higher Education Advisory Council and a mandate from the 1985 Minnesota Legislature, Coordinating Board staff conducted a project with three major goals: to assess and report on the uses of information technologies in Minnesota post-secondary education, to initiate collaborative activities to share information and resources among systems, and to provide opportunities for policymakers to review issues for policy development.

The staff report, Information Technology in Instruction in Minnesota's Post-Secondary Education Institutions, summarizes project activities, presents findings, and outlines policy options.

BACKGROUND

The project included a survey of Minnesota's post-secondary institutions; discussion with informed persons on campuses, at system offices, state agencies, corporations, and state and national organizations; and, a review of pertinent literature. The use of technology for instruction is at an early stage of development. The technologies are new to most potential users, and the capacity of the hardware (computers in particular) has far outpaced the availability of appropriate courseware for instruction. The use of information technology,

however, is beginning to increase rapidly and will involve changes in instructional content, sequencing, and methodology. Students will have opportunities for more self-directed learning.

In this period of change, the state should encourage, support, and recognize efforts by systems and institutions to experiment with and develop new uses of information technology. Care, however, should be taken to avoid expensive mistakes.

RECOMMENDATIONS

Based on its review of the staff study, the Coordinating Board on November 20, 1986 adopted the following recommendations:

1. **That the state provide financial incentives to systems and institutions to develop plans for the integration of information technologies into their instruction in ways consistent with their missions, resources, and priorities.**

Rationale. The present high pressure environment makes it easy for post-secondary institutions to make expensive mistakes. Too often expensive hardware decisions are made without recognizing the costs of courseware and technical personnel. Institutions often make short-term decisions that may not be right in the long-term. State incentives and leadership for planning can help institutions and the systems anticipate future needs in order to take purposeful short-term action, organize problem solving efforts, and preserve options.

Impact. Providing an adequate financial incentive to encourage all public and private post-secondary institutions to develop initial plans for the use of new technologies would require $600,000.

2. **That the state develop regional infrastructures to support institution and faculty sharing of resources and expertise in use of information technology.**

Rationale. Considerable activity is taking place on individual campuses. New developments will come about through efforts of individual faculty members and

through sharing of information and resources among these individuals. Resources are needed at the regional level to initiate the meetings and communications that can link the individuals and institutions and support the infusion of technology into instruction. These links could go beyond the post-secondary education sector and include the public schools, other public agencies, and the private sector.

Impact. Establishing regional centers in four areas of the state would cost $150,000 per year for each center, which would be $1,200,000 for the biennium.

2.a. That each regional center also serve as a state resource center in a special need area.

Rationale. The project findings indicate special need and opportunity in four areas: faculty development, courseware development and evalution, telecommunication instruction, and, teacher training in use of technology.

Impact. The cost of such special resource centers would be $40,000 per center per year for a total biennial appropriation of $320,000.

3. That the Coordinating Board continue its initiative to coordinate state policy development and provide leadership and assistance to effectively use information technology in post-secondary education.

Rationale. The Board can provide leadership and coordination for the post-secondary sector and work with other state agencies to give direction to technology and telecommunications policy. Specific opportunities and issues need to be addressed at the state level. These include: coordinate efforts to establish a statewide telecommunications network; assemble resources to assist institutional planning efforts; provide policy guidance to the legislature and systems, review developments in telecommunications instruction in Minnesota post-secondary institutions, telecommunications instruction being transmitted

from outside the state, and links with the public school efforts; and, keep informed on developments in information technology.

Impact. To sustain the effort already begun will require funds and staff. In its biennial budget proposal, the Board has requested $200,000 for this purpose.

4. **That the Coordinating Board continue to monitor instruction being offered in Minnesota by telecommunication from outside the state.**

Rationale. There is growing concern among coordinating boards around the nation regarding telecommunications instruction (distance learning). Quality, accreditation, and duplication of programs are at issue. Without specific cases to test the existing statute and rules, it is assumed that they are sufficient to protect the interests of the state and its residents.

Impact. Resources already exist within the Coordinating Board's Policy and Program Planning Division to monitor this issue.

5. **That the systems instruct their institutions to review policies or establish policies that protect the intellectual property rights of courseware creators and transmission.**

Rationale. The rapid proliferation of technology for direct copying of courseware and the transmission of courseware has often outpaced the applicability of policies protecting against illegal copying of material.

Impact. Periodic review of such policies is appropriate.

6. **That the Coordinating Board initiate actions with the Minnesota Department of Administration to review need and opportunities for post-secondary systems and state agencies to collaborate in increasing the capacity of the state's electronic transmission network(s).**

Rationale. Demand for electronic comunications links between communities, campuses, and state facilities is growing. The demand is for adminisrative data transmission, information base sharing, library collection sharing, and two-way interactive video conferencing and instruction. Deregulation of the telephone industry has produced uncertainty over cost of transmission. Technology nov in

place is unlikely to meet the burgeoning demand.

Impact. Present staff capacity is available to initiate meetings with appropriate state agency and systems' representatives. Legislative proposals to establish initial state policy direction in this area may result from these discussions.

7. **That the Coordinating Board instruct its executive director to work with HEAC members to determine if proposals by their system to expand post-secondary use of new information technologies in instruction and research can be combined into a single legislative initiative with broad-based post-secondary education support.**

Rationale. Most of the state's post-secondary education systems have developed proposals to the governor and 1987 Legislature to expand their use of information technologies. A single, coordinated initiative encompassing the proposals of the various systems and the Coordinating Board is likely to have a better chance for support by policymakers than several individual requests.

Impact. A coordinated initiative would meet state needs for the use of information technologies more efficiently than would several overlapping initiatives.

Executive Summary

The rapid proliferation of information technologies--which include all video, audio, and computer technologies--has accentuated the need for a systematic gathering, assessment, and dissemination of information about these technologies and their impact on post-secondary education policy.

In response to interest from the Higher Education Advisory Council and a mandate from the 1985 Minnesota Legislature, the Coordinating Board conducted a project with three major goals: assess and report on the uses of information technologies in Minnesota post-secondary education, initiate collaborative activities to share information and resources among systems, and provide opportunities for policymakers to review issues for policy development.

Background

The first goal was achieved through a survey of all post-secondary institutions completed in fall 1985 and a report of the findings disseminated to system administrators at a June 1986 conference. The other goals were realized through a report on the major issues in information technologies in fall 1986 with policy options for addressing these issues.

The survey was designed to provide a statewide profile of the use of information technologies. It was based on a 1984 survey developed for the Western Interstate Commission for Higher Education. Of 99 institutions surveyed, 91 responded.

Findings

Following are observations that were found prevalent in Minnesota institutions:

- Computers were by far the most popular information technology. Computer-assisted instruction (CAI), computer-assisted design (CAD), and on-line library searches and data base searches headed the list of uses. Stand-alone microcomputers were extensively available to both students and faculty, with IBM PC's (compatibles) and Apple II's predominating. Many institutions expressed the need to purchase more computers, expand computer labs, increase accessibility, and enhance networking capabilities (mainly on campus). Computers also were evident in the limited use of combinations of the technology, with computer/facsimile and computer videodisk the most common combinations.

- Video was the second most popular information technology, with video cassette the clear favorite both for on and off campus use. Satellite-receive, closed circuit television, and public and commercial broadcast television were also heavily used. Satellite dishes are now available or planned for on most campuses of public institutions. Several institutions expressed an interest in obtaining more information on the newer delivery mediums, such as fiber optics cable, as well as interactive technologies, including two-way interactive television.

- The least popular information technology was audio, although audio cssettes enjoyed substantial use both on and off campus. Broadcast FM radio was a distant second. On campus, regular telephone and audio teleconferencing were somewhat popular. Few institutions asked for added information on audio technology in the open-ended questions.

Some other findings were:

- There is little emphasis or incentive for faculty development of courseware; little is available for purchase or lease.

- Few institutions have working relationships with a public broadcast television or radio agency.

- The highest use of information technologies was in the social sciences, humanities and physical and biological sciences.

- The major incentive for faculty to incorporate technology into their courses was workshop/training session, with almost no recognition for use in promotion or tenure policies.

- Information-sharing, networking, and shared previev and

evaluation of courseware were the most important areas identified for potential collaboration among post-secondary institutions.

- o The major obstacles for use of technology were financial, lack of quality courseware and logistical complexities involved in supporting student learning.

- o Respondents said that the most important action that higher education policymakers can take is to provide additional funding for technology.

The findings indicate:

- o There is considerable interest and activity in use of technology in Minnesota's post-secondary institutions.

- o There are considerable differences between institutions in their expertise and use of technology.

- o There is a need for formal, comprehensive planning at the institutions if the use of technology is to be expanded.

- o There is a need for resources to support faculty development programs in the use of technologies.

- o There is a need and desire to share and collaborate in the expertise and use of technology.

- o There is an opportunity to build linkages between resources in post-secondary education institutions, public school systems, other government agencies and industry.

Issues and Options

The findings and conclusions raise issues relating to funding, faculty development, courseware, intellectual property rights, statewide telecommunications, regulation, collaboration, and planning. Following is a description of the issues and policy options for addressing them.

Funding

The issue. Costs of technology are not particularly related to enrollment increases or decreases. The appetite for use expands rapidly as computer equipment and networks are made available. Hardware and software maintenance and support costs are underfunded.

Administrators are under pressure to allocate more funds for information technology.

Policy Options: Possible approaches to funding include the following:

- o Internal reallocation.
- o Incentive and/or competitive grants to stimulate individual faculty members, departments, or institutions to introduce new technologies, cover start-up costs and faculty development.
- o User fees, tuition surcharges, or special appropriations for technology acquisition and support services.

Faculty Development

The issue. In Minnesota, less than one-sixth of the institutions offer a significant level of special orientation or training. Most reported offering training to less than one-fourth of their faculty. Faculty development, however, is a key need. Special courses need to be individualized to meet the needs of particular academic discipline areas and specific applications.

Policy Options: Ways to promote faculty development could include the following:

- o Incentive grants available to systems, to institutions, or to academic discipline associations to develop high quality, faculty development programs for specific subject areas.
- o Recognition and support of those who are making effective use of technology.
- o Establishment of a state center for support of faculty training materials, inter-system sharing, and technical assistance.

Coursevare

The issue. The lack of courseware available that meets academic needs and standards of an institution is rated the second largest obstacle to effective use of information technologies, behind funding.

Two factors that create this problem are low faculty interest in developing courseware and the high costs of producing courseware. Commercial production is plagued by high production costs, a fragmented market, and institutional copying of commercial programs rather than purchasing additional packages from the commercial vendor.

Policy Options. Alternatives to address this issue include the following:

- o Do nothing and expect the market place (commercial development) to satisfy the demand over time.
- o Revise tenure and promotion policies to recognize the intellectual and instructional value of courseware that meets scholarly criteria.
- o Establish a state center for encouraging courseware development, evaluation, distribution, and previev and to maintain a central data base of instructional support software available from external and internal sources.
- o Identify and collaborate with national efforts to improve courseware quality and distribution.
- o Aggressively pursue site licensing and bulk purchasing agreements.

Intellectual Property Rights

The issue. Originally the law which governed patents, copyrights, and trademarks was simple: property rights were granted specifically to the author and inventor. Now, technology including computer, two-way interactive video, and satellite transmission, has created problems in clearly defining intellectual property. Protecting the rights of software designers and producers of telecommunications transmissions is a major problem that affects development and use of educational courseware and reception of programs from other institutions.

Policy Options: Options are as follows:

- o Recognize that the federal government has the major responsibility in this area.
- o Have explicit system and institutional policies and guidelines governing staff and student behavior regarding copying of materials.

Statewide Telecommunications Network

The issue. Demand for electronic communications links between communities, campuses, and state facilities is growing. The demand is for administrative data transmission, information base sharing, library collection sharing, and two-way interactive conferencing and instruction. Deregulation of the telephone industry has produced uncertainty over cost of transmission. Technology now in place is unlikely to meet the burgeoning demand.

Policy Options. Possible approaches to meet this demand includes:

- o Collaborative study and action among state agencies and the higher education systems to promote sharing of resources and development costs of expanded capacity.
- o Explore with the private sector on expanding communication networks using fiber optics cable to link major state communities.

Regulation of Distance Learning

The issue. Long distance learning via technology enables institutions to offer educational programs originating outside the state to citizens anywhere in the state. Developing applicable policies, criteria, and procedures for accrediting and authorizing telecommunications-based long distance programs and institutions to ensure and encourage basic consumer protection is a statutory responsibility of the Coordinating Board.

Policy Options. Existing statute regulating private colleges provides adequate authority to meet concerns regarding regulation of

public and private institutions located outside the state. Existing Coordinating Board policies and procedures appear appropriate and adequate.

Collaboration Between and Among Institutions and Faculty

The issue. The cost of supporting technology, the rapidly changing nature of hardware and courseware, and the decentralized nature of post-secondary education create special problems in effective and efficient use of technology for instruction. Findings indicate a desire for collaboration in acquiring and using hardware and data bases, sharing courseware and expert knowledge, and sharing knowledge about special programs existing in other institutions, public schools, and industry. Communications and decision patterns are specific to institutions and systems with few incentives or opportunities to make contact with geographically proximate institutions.

Policy Options: Options include the following:

- o Provide resources to initiate state conferences, newsletters and other initiatives to share information and provide forums for special interest sharing.
- o Establish a capacity in regional centers with responsibility to build an infrastructure of activities and personal networks to promote collaboration and sharing of resources and expertise.

Planning

The issue. Because this is a rapidly, constantly changing field and a costly one, it is difficult to estimate ongoing costs, to keep up with needs and developments on campus, and to be aware of resources available in other institutions and the community. The missions of institutions differ so their need for and use of technology will differ.

Institutional planning is a first step likely to focus and give

direction to the next phase in the use of information technology for instruction.

Policy Options. Ways to enhance planning include the following:

o Provide incentives for institution planning efforts.

o Provide state technical assistance capacity.

Conclusion

For the past several years state government has supported policies to encourage and promote the use of information technology for instruction. As a result of legislative initiatives in 1983, Minnesota has become a national leader in the use of technology in the public schools.

Minnesota has an opportunity to become a leader in technology for post-secondary education. Significant use of technology already is occurring as a result of special legislative appropriation and internal reallocations by institutions and systems. Projects such as the supercomputer capacity at the University of Minnesota and systemwide library automation among the state universities and the community colleges have received national attention. Continued achievement will require an integrated package of policies and significant resources.

Policy initiatives and resources that can contribute to the state's educational and economic development goals would support:

- o Institutional planning for the use of technology in instruction with resources available for first step implementation of plans.
- o The development of regional infrastructures to support shared use of resources, collaborative actions and special programs to support the institutions and public schools in acquiring and effective use of the new technologies.
- o The establishment of centers of excellence to serve the special needs of post-secondary education in areas of faculty development, coursevare development and evaluation,

telecommunications, and teacher training for technology.

- A central capacity to provide leadership and planning assistance to the effort.

CONTENTS

EXECUTIVE SUMMARY..... i

CONTENTS..... xi

TABLES..... xiii

CHAPTER I. INTRODUCTION..... 1

MANDATE
OBJECTIVES
PLAN OF WORK
Describing the Use of Information Technologies in Minnesota's Post-Secondary Education Institutions
Informing Policymakers
Collaborating to Share Information and Resources
CONTENTS OF REPORT

CHAPTER II. IMPORTANCE OF INFORMATION TECHNOLOGY TO MINNESOTA POST-SECONDARY EDUCATION..... 9

EDUCATIONAL GOALS
CONTRIBUTION TO THE STATE'S ECONOMIC DEVELOPMENT AND VITALITY
COST OF INFORMATION TECHNOLOGY

CHAPTER III. INFORMATION TECHNOLOGY IN INSTRUCTION: FINDINGS REGARDING THE USE OF COMPUTER, VIDEO, AND AUDIO TECHNOLOGY..... 17

COMPUTER TECHNOLOGY
Minnesota Data
National Data (from CPB 1984-85 survey)

VIDEO TECHNOLOGY
Minnesota Data
National Data (from CPB 1984-85 survey)

AUDIO TECHNOLOGY
Minnesota Data
National Data (from CPB 1984-85 survey)

CHAPTER IV. INFORMATION TECHNOLOGY IN INSTRUCTION: FINDINGS REGARDING OBSTACLES AND ISSUES..... 31

OBSTACLES

ISSUES
- Costs
- Faculty Development
- Courseware
- Networks and Potential Areas for Collaboration
- Planning
- Regulation of Distance Learning
- Intellectual Property Rights

CHAPTER V. IMPLICATIONS FOR STATE POLICY..... 43

OPTIONS
- Funding
- Faculty Development
- Courseware
- Intellectual Property Rights
- Statewide Telecommunications Network
- Regulation of Distance Learning
- Collaboration Between and Among Institutions and Faculty
- Planning

CONCLUSION

APPENDICES..... 51

APPENDIX A. GLOSSARY OF TERMS

APPENDIX B. FUNDING A COMPUTER INFRASTRUCTURE IN HIGHER EDUCATION

APPENDIX C. SURVEY QUESTIONNAIRE

TABLES

TABLE 1: NUMBER OF INSTITUTIONS USING EACH TYPE OF HARDWARE TO DELIVER INSTRUCTION TO LEARNERS (OTHER THAN COMPUTER SCIENCE STUDENTS)..... 19

TABLE 2: COMPUTER APPLICATION USED BY REPORTING INSTITUTIONS.... 20

TABLE 3: VIDEO TECHNOLOGIES USED BY MINNESOTA POST-SECONDARY INSTITUTIONS..... 24

TABLE 4: AUDIO TECHNOLOGIES USED BY MINNESOTA INSTITUTIONS..... 27

TABLE 5: OBSTACLES TO MORE EFFECTIVE USE OF INFORMATION TECHNOLOGIES..... 32

CHAPTER I. INTRODUCTION

Information technology is emerging as a key issue in post-secondary education because it could significantly change the delivery of instruction in post-secondary education and alter administrative practices. This area of technology includes audio, video, and computer technologies; it also encompasses communication systems such as direct broadcast satellite, two-way interactive cable, low power broadcasting, computers (including personal computers), and television (including video discs and video cassettes).

The importance of information technology has been recognized by state agencies, commissions, and the Minnesota Legislature. The Commission on the Future of Minnesota Post-Secondary Education, for example, emphasized information technology as an emerging issue in its April 1984 report to Governor Rudy Perpich:

> Few if any changes in the history of education hold out the potential for altering the delivery of instruction more than the advent of micro-circuitry, computation, and telecommunications. Micro-circuitry enables an incomprehensible number of computer instructions to be executed each second, thereby permitting the processing of complex algorithms which give the machine "artificial intelligence." Telecommunications permit the delivery of instructional resources at homes, offices, and remote locations where instruction might otherwise be unavailable.
>
> As educational material becomes more complex, it is unrealistic to assume that all institutions will be able to provide the level of instruction their students need or want. This is already evident

> in the secondary school systems as resources grow ever tighter. As issues of quality and access continue to be of paramount importance, instruction technology holds out the possibility of partial solution.1

In the same year, the Higher Education Advisory Council identified instructional technology as a priority issue and recommended that special emphasis be given to it in the Higher Education Coordinating Board's management plan. In 1984, the Board's plan reflected this priority:

> Currently many institutions are adopting various uses of instruction technologies, but there is little or no coordination of these efforts between institutions and systems. Through this emphasis the Board would coordinate an effort to examine the potential for use of instructional technology in Minnesota post-secondary education. Radical technological changes will have significant impact on society in the next ten years. The acceleration of technological changes will disrupt many of the traditional concepts of who should control the quantity and quality of education services. This effort would review some of the anticipated effects on the state's traditional institutions of the revolution in technology. It would explore the questions that arise concerning governance, quality, accreditation and consumer protection as new forms of delivering educational services are developed in response to the availability of new technologies.
>
> In addition to exploring these issues, this coordinated effort would develop a plan for sharing resources and experience to facilitate the development of instructional technologies in Minnesota.2

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1 Commission on the Future of Minnesota Post-Secondary Education, Post-Secondary Education in Minnesota: A Commitment to Quality, Access and Diversity (April 1984).

2 Minnesota Higher Education Coordinating Board, Management Plan 1984-87 (September 1984).

During the 1985 session, legislators expressed interest in an initiative to develop state policy and to encourage the use of technology. Technology policy is in a state of flux and there is time to shape and coordinate planning at the state level.

MANDATE

The Minnesota Legislature directed the Higher Education Coordinating Board to:

> initiate activities to coordinate state policy development regarding the use of information technology in post-secondary education instruction and administration. These activities shall include at least the following: a survey, conducted in collaboration with the post-secondary education systems, of existing information technology use and needs of institutions and regions, initiation of collaborative activities to share information and resources; and provision of opportunities for post-secondary policymakers to review issues and needs of policy development.3

The legislature further directed the Board to present a report on the findings and activities regarding information technology by December 1, 1986.

OBJECTIVES

This project was designed to describe the present use of information technology in instruction and to promote the coordinated planning and use of information technologies at both the policy and operating levels in Minnesota post-secondary education. Policy development includes possible recommendation for state and systems' policies that provide incentive for coordination and support the use and sharing of

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3 Laws of Minnesota 1985, First Special Session, Chapter 11, Section 3, Subd. 2.

information technology resources. Educational and political leaders can guide policy development in this rapidly changing, complex field only if they are well informed.

The objectives of this project are:

- To provide a state perspective on the uses of technology in Minnesota post-secondary education.
- To assess and report the need for state level policy development.
- To inform policymakers of trends, practices, opportunities, and issues in the use of the new technologies.
- To provide opportunities for practitioners to learn about and to share resources and plans regarding the use of information technology.

PLAN OF WORK

Several methods have been used to meet the project goals. They include the following:

- A survey of Minnesota post-secondary institutions.
- A comparison of the results of the Minnesota survey with those done in other states, such as the Western Interstate Commission for Higher Education (WICHE) surveys of northwestern and southeastern states, and on a national level, such as the Corporation for Public Broadcasting (CPB).
- Publication and dissemination of the results of the Minnesota survey.
- Collection of literature from state higher education institutions on technology plans and implementation in their system or in individual institutions and from national journals and conferences to establish a body of information and resources about information technologies.
- Symposium and forums featuring state and national experts on various areas of information technologies.
- A report to the legislature providing an overview of state and national issues concerning information technology.

Describing the Use of Information Technologies in Minnesota's Post-Secondary Education Institutions

Permission was received to adapt a survey instrument designed and used by the WICHE. Administrators in 91 of 99 Minnesota public and private post-secondary institutions responded to the survey. Tables describing the use of information technology by institutions in Minnesota were developed. Data related to a specific system were summarized and reported to the system's office. Since systems differ, the use of technology will differ, so a comparative analysis was not conducted. Data from the 1984 survey of the Corporation for Public Broadcasting (CPB) and the National Center for Educational Statistics survey, which surveyed all colleges in the nation as part of a Higher Education Utilization Study, are made available by the CPB. This, combined with the HECB survey results, provided a comprehensive view of information technology use by higher education institutions in Minnesota.

Structured interviews with administrators concerning system-level policies, plans, priorities, and issues supplemented information gathered by the survey. Additional information on state post-secondary institutions was gathered through site visits to campuses and Minnesota state agencies and organizations that have been involved with information technology issues and activities. These sources helped identify special projects and resources available at the state level. Contact with other states and with national higher education

associations and an extensive review of the literature (papers, reports, articles, and planning documents) also augmented the survey results.

Informing Policymakers

Several efforts already have been made to inform policymakers about issues and options. During the project, two seminars for legislators, systems' leaders, and policy staff were conducted to explore issues and implications for Minnesota related to technology. Also, over 300 people from Minnesota's post-secondary education community attended a symposium on the workforce of the future sponsored by the HECB in collaboration with the post-secondary systems and the State Planning Agency to explore the impact of technology upon educating the workforce.

Collaborating to Share Information and Resources

Encouraging collaborative activities to share information and resources is on-going. Meetings with individuals at the system offices have been held regularly during the project. An ad hoc group with special interest in telecommunications has met quarterly. During Fiscal Year 1987, presentations at state and regional conferences are planned, and initiatives to explore collaborative opportunities will occur.

CONTENTS OF REPORT

Chapter II of this report discusses the importance of information technology to Minnesota post-secondary education. Chapter III reports on findings regarding use of computer, video, and audio technologies, and Chapter IV reports on issues and obstacles to their use. Chapter V discusses implications for state policy. A glossary of terms is included as Appendix A.

CHAPTER II. THE IMPORTANCE OF INFORMATION TECHNOLOGY TO MINNESOTA POST-SECONDARY EDUCATION

Information technology has great potential for improved learning opportunities, for preparing students to succeed in a technologically advanced society, and for helping the state maintain and gain a competitive edge in economic development. To achieve this potential, however, it is necessary to recognize the substantial costs of purchasing hardware and courseware and the expense of supporting the use of information technology systems on campuses.

EDUCATIONAL GOALS

Education has come under increasing pressure to prepare students for the demands and potentials presented by the explosive growth in technology. Critics have charged that many colleges and universities have been slow to assume their responsibility for training in technology, or have relinquished it altogether, and that private industry has been forced to assume this function.4

Of all the technologies, computers are the most pervasive and have the most impact on instruction. At whatever level of use, most post-secondary students will expect, even demand, both instruction in and access to computers. Computer literacy, however one might define

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4 John A. Riccobono, Status of Instructional Technology in Higher Education. Corporation for Public Broadcasting and the National Center for Educational Statistics; Preliminary Draft (September 1985).

it, is a major educational concern of Minnesota post-secondary institutions. This literacy encompasses the ability to use the computer effectively in professional activities and for the user to be comfortable with the computer by knowing its strengths and its weaknesses. Also, it is becoming increasingly important as computers proliferate, to have a reasonable indication of what to expect from a well-designed information system.5

Computers are used for a wide range of instruction, from simulating a model factory to using a word processor to using computer designed and controlled instruments. These are but a few examples of the diverse applications of the computer in the institutional situation.

The value of technology in improving achievement by learners is not clearly defined or documented. Improved learning has been demonstrated in some settings, but often the costs of delivering that instruction via technology are high. In a review of electronic learning, the CPB concluded that:

1) Media can teach. With the right software, hardware and mindware, children can and do learn using mediated instruction.

2) The medium is not the message. The choice of medium accounts for only a small portion of the impact of electronic instruction and then by and large, the knowledge gained from similar programming in different media is the same.

3) Learners' mindware, i.e., expectations about the instructional lesson (technology based or otherwise) affect the way they attend to the lesson and thus its effectiveness.

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5 James Emery, "Issues in Building an Information Technology Strategy," EDUCOM Bulletin (Fall 1984).

4) Software (programming form and content) is the key to effective teaching and learning with media.

5) Finally, cost, convenience and efficiency in using media and technology to meet learners' needs will almost always be a determinant to use. The use of video instructional programming, for example, has been greatly enhanced by video cassette recordings (VCRs), which offer teachers convenience, flexibility and control in use of programming in their classrooms.6

CONTRIBUTION TO THE STATE'S ECONOMIC DEVELOPMENT AND VITALITY

High technology industries are vital to the economic vitality of Minnesota. A recent national survey pointed out that:

- The potential contribution of universities has generally been ignored or underestimated by localities. The survey shows that if properly utilized, higher education, and secondary education as well, may play the major role in helping a community or region attract high-technology firms...Unlike the more traditional manufacturing companies, high-technology companies apparently seek out a community noted for the excellence of its academic institutions, particularly in the sciences. Academic institutions ranked among the top five determinants of high-technology location decisions.

- High-technology centers in California and Massachusetts are not only contributing to growth of their states' economies, but they are generating positive employment gains, or "spread effects," in states within their respective regions.

- The three most important determinants for high-technology locational choices are labor skills/availability, labor costs, and state and local taxes. Increases in the nation's high-technology firms are expected in the midwest, southeast, southwest, and mountain and plains states. The most significant gain is expected in the midwest ... (The midwest's) labor markets compared favorably with the far west ... its academic institutions were ranked above academic institutions in the southeast, southwest, and the mountain and plains states, and it had fewer low ratings on the other locational attributes (e.g., cost of living and cultural amenities) than the other regions.

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6 The Corporation for Public Broadcasting, Research Notes, Number 15 (April 1986).

- o The type of manpower needed to attract high-technology industry includes technical, professional, and skilled (in that order), indicating the importance of two-year, four-year, and graduate-level manpower training programs. Manpower problems must be addressed because manpower is the single most important determinant in a company's decision to locate in a new site.7

A more recent report on Minnesota's technology-intensive industries supports the conclusions of the national survey, particularly on the importance of labor skills availability and consistent supply of highly qualified graduates in technology areas from academic institutions:

- o The overall contribution of Minnesota's technology-intensive industries to the state economy has increased dramatically over the last decade. There is every indication, moreover, that these industries will continue to grow during the coming decade.

- o Total employment in the technology-intensive industries has increased greatly during the last twenty years. A comparison with agriculture, mining, and the timber industry--the three industries which historically have contributed most to the growth of the state economy--reveals that the technology-intensive industries now employ more workers than the three other industries combined.

- o The growth of the technology-intensive industries in Minnesota is directly and heavily dependent on the availability of engineers, scientists, and math/computer specialists in the state. Based upon 1980 figures, employment in these technology-related occupations in Minnesota has been increasing at a rate almost three times that for state employment as a whole. Projections indicate that this demand will continue to grow.

- o However, the supply side of the technical personnel question is what will determine the capacity for the growth of Minnesota technology-intensive industries. From today's viewpoint, it is clear <u>the supply of new technical trainees will not meet the projected demand</u>.

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7 Joint Economic Committee of the Subcommittee on Monetary and Fiscal Policy of the United States Congress, "Location of High-Technology Firms and Regional Economic Development" (May 1982).

- o Finally, the study highlights the problems of training engineers, scientists, and math/computer specialists in adequate numbers to meet the growing demand for their specialized skills. When lagging supply fails to meet growing demand for technology-rated skills, the future growth of Minnesota's technology-intensive industries will be jeopardized.8

COST OF INFORMATION TECHNOLOGY

The cost implications for post-secondary institutions of the use of information technology in instruction cannot be ignored. Although it is difficult to fix a standard budget allocation that applies across a broad range of institutions, general guidelines are possible. The allocation of funds for non-hardware resources is particularly important as most institutions significantly underbudget these resources and end up hardware rich and service poor.

An estimate of what the cost allocation for computer technology ought to be is given below. A more detailed outline of estimated costs for a computer infrastructure is printed in Appendix B. The expenditure level shown for hardware is capital cost spread over the useful life of the equipment (as if the hardware were acquired through a lease arrangement):

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8 Wilbur Maki and Hossien Akhavipoir, The Rise of Technology Intensive Industry in Minnesota. Minnesota High Technology Council (December 1984).

Hardware	20%
Purchased Software	20
Communications	10
Technical support	40
Maintenance	10
	100%9

This is not representative of current practice; in fact, it differs substantially from explicit expenditure patterns at most institutions by allocating more to non-hardware costs. Because of widespread under-budgeting for support services, users bear most of this cost. The cost is real, nevertheless, so the figures above probably provide a more realistic picture than is shown by formal budgets.

The continuing rapid drop in hardware prices is unlikely to affect the need for administrators to find significant new money to support rapid growth in demand. In a reasonably supported operation, hardware costs could average less than a quarter of total costs, so a relatively small portion of the computing budget is affected by reductions in hardware costs. Even this small reduction often is offset by the high expenditures needed to meet the demand for expanded work stations and accessibility. Furthermore, as faculty members, administrators, and students demand more sophisticated and higher quality software and support services, the costs of maintaining the

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9 James Emery, "Issues in Building an Information Technology Strategy," EDUCOM Bulletin (Fall 1984).

system will continue to grow. Over the next few years, many institutions face the unexpected and unplanned for prospect of having to provide for a significant increase in expenditures for activities other than hardware with these costs coming largely from internal reallocation. Other institutions choose to abandon hardware gifts because maintenance and technical support costs cannot be met.

CHAPTER III. INFORMATION TECHNOLOGY IN INSTRUCTION: FINDINGS REGARDING THE USE OF COMPUTER, VIDEO, AND AUDIO TECHNOLOGY

To describe current use of computer, video, and audio technologies in the delivery of instruction in Minnesota post-secondary education institutions, the Coordinating Board gathered information through a survey of public and private institutions and through interviewing key informants in systems offices and on campuses.

The Survey of Instructional Uses of Information Technology in Post-Secondary Education in Minnesota was an adaptation of a survey form used by the Western Interstate Commission for Higher Education (WICHE). The questionnaire consisted of 24 multiple response items inquiring about kinds of technologies used, collegiate level, and curricular areas of use, and factors affecting the use of information technologies (see Appendix C).

The questionnaire also included open-ended questions regarding unique or noteworthy features in the use of information technologies, problems the respondent had encountered in the use of technology, future plans, and special programs using information technologies.

The survey was sent to academic administrators in 99 public and private institutions in the state. Ninety-one institution representatives responded. The University of Minnesota was surveyed at the college level, resulting in 23 responses of the 91. This chapter

summarizes the findings of the survey. To gain a broader perspective, national information was drawn from a survey of 2,830 institutions conducted by the Corporation for Public Broadcasting (CPB) and the National Center for Educational Statistics.10

While Minnesota has, overall, more technologies available in all categories at a higher level of use than most other states, according to CPB's 1984 survey, problems identified by Minnesota's post-secondary institution administrators center on the same issues as in other states:

- o funding and budgetary allocations
- o networking compatibility
- o accessibility of technology to students and faculty
- o logistical constraints
- o lack of quality courseware development and evaluation
- o lack of faculty training and incentives to integrate technology into the classroom
- o too few technical support personnel
- o cost-effectiveness of alternative delivery systems for instruction
- o collaboration and information sharing among institutions

COMPUTER TECHNOLOGY

Computers have revolutionized the way information can be processed and transmitted in post-secondary institutions; they have provided a model for new fields of research into the way the human mind processes and transmits information. No field or curriculum area has remained

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10 John A. Riccobono, Status of Instructional Technology in Higher Education. Corporation for Public Broadcasting and the National Center for Educational Statistics, Preliminary Draft (September 1985).

untouched by the facility and speed of computers, whether for statistical analysis, business applications, graphic design, instructional management, word processing, library automation, or data base searches.

The accelerated use of computers has signaled a change in the delivery of instruction in post-secondary education by:

- o increasing the access of both students and faculty to information.
- o providing instructional management applications to assist in learning.
- o enhancing the hands-on experience to prepare students for successful competition in the workplace.

Minnesota Data

A high use of stand alone microcomputers for instruction appears in Minnesota institutions, as shown on Table 1. The proportionally high interest, accessibility, and use of computer technology for instruction reflects the aggressive promotion by the computer industry, especially IBM and Apple which dominate the computer hardware orientation in post-secondary institutions.

TABLE 1: NUMBER OF INSTITUTIONS USING EACH TYPE OF HARDWARE TO DELIVER INSTRUCTION TO LEARNERS (OTHER THAN COMPUTER SCIENCE STUDENTS)

Type	Medium Use	High Use
Mainframe	16	8
Minicomputers	27	18
Microcomputers (stand alone)	35	35
Microcomputers (Network)	21	10
Time-Sharing Terminals	15	10
Other		

SOURCE: Higher Education Coordinating Board, Survey of Instructional Uses in Post-Secondary Education in Minnesota (June 1986).

Computer-assisted instruction (CAI) is by far the most widely used application (78) in institutions, with computer managed instruction (CMI and CBIM) used by 29 and 21 institutions respectively, as shown in Table 2. Computer-assisted design (39), simulation (52), and modeling (33) (CAD) also are used often.

Library-oriented use of technology, which is cited by institutions as a priority in future plans for expansion, is evident with over one-third of the institutions reporting on-line library catalog searches (42) and over half reporting library on-line data searches (48).

TABLE 2: COMPUTER APPLICATION USED BY REPORTING INSTITUTIONS

Type	Number of Institutions (N = 91 Institutions)
Computer-Assisted Instruction	78
Simulation/Gaming	52
On-Line Data Base Searches	48
On-Line Library Catalog Searches	42
Electronic Mail	42
Computer-Assisted Design	39
Modeling	33
Computer-Managed Instruction	29
Computer-Based Training	29
Computer-Based Instructional Management	21
Computer Conferencing	8

SOURCE: Higher Education Coordinating Board, Survey of Instructional Uses in Post-Secondary Education in Minnesota (June 1986).

In the open-ended question responses, most Minnesota institutions reported plans for expansion of their computer technology. They cited plans for more computer labs, increasing networking capabilities, and emphasizing more development and use of computer-assisted instruction (CAI) software. Few unique programs were reported by the institutions. Use of computers in student support services, such as career planning and counseling centers, is common. One institution offers a computer camp for adults and children.

National Data (from CPB 1984-85 survey)

Virtually all two-and four-year public institutions indicated computer availability and almost four of five private two-year and 93 percent of private four-year institutions indicated computer facilities/equipment available for faculty or student use. By contrast, however, computers available for instructional use in private schools were most likely stand-alone microcomputers, whereas the vast majority of two- and four-year public institutions had both mainframe/minicomputers and microcomputers available for instructional purposes.

Nationally, the most common uses of this equipment by students were for hands-on learning about the uses of computers and for instructional use of general purpose applications software, such as word processing and spread sheets. These were also the most frequently named faculty uses of computers. Another commonly named student use of computers, (found in four of five institutions), was the programmed exercise, tutorial, and/or drill. The fastest growing area of computer use among students and faculty, according to most institutions, is in the instructional use of general purpose applications software.

Almost three out of four institutions with mainframe/minicomputers offered courses requiring students to use software or data bases installed on this equipment. Four-year institutions (81 percent) were proportionately more likely to have offered these courses, and, on the average to have offered more of these courses.

Nationally, almost one-fourth of the institutions with computers available for instructional use had formal policies regarding computer literacy requirements for some or all their undergraduate students. The most frequently specified elements of such policies were that students should take an introductory computer course for credit and should know general procedures for using "canned" software. Aside from student computer literacy requirements, about 70 percent of institutions with computers had formal policies governing the use of this equipment. Access to computers by students and faculty was the area most frequently covered by these policies.

About two-thirds of the two- and four-year institutions offered some training for faculty in the instructional uses of computers during 1984-85. On average, faculty training in the use of computers offered by these institutions ran from 10 to 15 hours and almost always involved training in the operation of equipment and of "canned" applications software.

The CPB study also found that about two-thirds of all colleges and universities were providing financial assistance (discount prices, loans, grants, group purchase) to students and/or faculty buying

computer hardware. Such assistance was most often offered to both faculty and students, although substantial numbers of institutions restricted such assistance to faculty only.

VIDEO TECHNOLOGY

Although computer technology often receives more attention than video technologies, the video cassette is the single most popular of the information technologies for delivering instruction. In the CPB report, 100 percent of the two-year and four-year institutions surveyed reported use of prerecorded video cassette or video disc. Those reporting for Minnesota revealed a slightly lower use at 85 percent. The video cassette is a relatively inexpensive, flexible, compact, and cost-effective means of distributing instruction.

Minnesota Data

The most popular video technology for instruction is the video cassette, as shown in Table 3. The satellite-receive is used by 33 institutions with both public broadcast television and commercial broadcast television in frequent use.

The technologies least employed in providing instruction are low power television, teletext, point-to-point microwave, satellite-send, and electronic blackboard. The use of these two-way interactive technologies might be limited because of financial considerations or lack of information, both concerns expressed by the institutions in responses to the open-ended questions.

TABLE 3: VIDEO TECHNOLOGIES USED BY MINNESOTA POST-SECONDARY INSTITUTIONS

Type	Number of Institutions (N = 91 Institutions)
Video Cassette	80
Broadcast TV, Public	48
Satellite-Receive	33
Cable TV, One-Way	31
Closed Circuite TV	30
Broadcast TV, Commercial	27
Videodisc	21
Video Teleconference-One Way Video	19
ITFS	15
Slow-Scan, Freeze-Frame	12
Cable TV, Interactive	11
Point-To-Point Microwave	7
Video Teleconference-Two Way Video	4
Satellite-Send	4
Videotext	3
Direct Broadcast TV	3
Electronic Blackboard	3
Teletext	2
Low Power TV	1

SOURCE: Higher Education Coordinating Board, Survey of Instructional Uses in Post-Secondary Education in Minnesota (June 1896).

National Data (from CPB 1984-85 survey)

The CPB investigation concentrated on the availability of various central reception/distribution facilities. The most frequently named methods of video central reception, regardless of institution type, were community cable system drops and master TV antenna, with about one-half and one-third, respectively, of all institutions indicating availability of these facilities. For distribution/exhibition of video material, special video or film screening/projection room was the most frequently named facility at all types of institutions, followed by campus closed-circuit TV, community cable TV systems, and cable TV educational access channels.

With regard to video technology, the CPB study found that the most frequent institutional use was one-way presentation on campus. More than 80 percent of all institutions indicated such use. About one-third of all institutions used video for one-way presentation of instruction to off-campus students; however, about half the public two- and four-year institutions reported using video in this manner.

A focal point of the CPB study was the extent to which institutions were offering credit and non-credit courses involving substantial use of video or audio technologies in the delivery of instructional materials. A total of 902 (or 32 percent) responding colleges and universities were found to have offered one or more "video telecourses" during 1984-85. Video telecourses were offered by half of all public two-year schools and 44 percent of public four-year schools. In contrast, only about 17 percent of the private four-year and 5 percent of the private two-year schools offered such telecourses.

CPB attempted to assess the extent to which institutions employed video technology for live or "real time" distribution of instruction to students on or off-campus. The extent of such use is constrained by the availability of appropriate equipment/facilities. Nonetheless, the study found that about one of four colleges and universities used live camera in-the-classroom television to some extent in 1984-85. Such use was greatest among professional/graduate schools (42 percent) and proportionately higher among four year public schools than four-year private schools or two-year schools.

The national findings related to faculty training in use of video technologies for instruction closely paralleled those for computers, although training offered in video was generally less extensive. Aside from training, about three fourths of the institutions provided organized expert assistance (special staff or faculty committees) to faculty wishing to use video for instructional purposes.

About half the faculty nationally are reported as being given informal training in video technology for instructional application, with less than one-third given any structured, formal instruction. Administrators in Minnesota report that half the faculty has easy access to video classrooms or studios, and three-fourths have technical support in the use of video technology.

AUDIO TECHNOLOGY

Except for the audio cassette, audio is not an extremely popular technology.

Minnesota Data

The cassette is the most popular of the audio technologies with 60 institutions using the cassette, as seen in Table 4. A distant second and third are audio teleconferencing, reported by 20 institutions, and regular telephone service, used for instruction by 19 institutions.

TABLE 4: AUDIO TECHNOLOGIES USED BY MINNESOTA INSTITUTIONS

Type	Number of Institutions (N = 91 Institutions)
Audio Cassette	60
Audio Teleconferencing	20
Regular Telephone Service	19
FM Radio, Public	17
AM Radio	12
FM Radio, Commercial	8
Cable Radio	3
Facsimile	2
Radio Talkback	2
SCA Radio	1
Audiographics	0
Other	2

SOURCE: Higher Education Coordinating Board, Survey of Instructional Uses in Post-Secondary Education in Minnesota (June 1986).

The HECB Information Technologies survey indicates little concern for courseware development, and no institution mentioned audio technology in planning for the use of information technologies. Few institutions have either informal or formal working relationships with public radio agencies.

National Data (from CPB 1984-85 survey)

Nationally, for audio, distribution was most likely through language labs and music listening rooms, both using audio cassettes. Central reception and distribution facilities/equipment were substantially more available to two- and four-year public schools than to their private school counterparts. Audio courses were offered by only nine percent of the institutions; the great majority of such course use was with introductory or lower division courses, with two-thirds of the offerings being at this level.

These findings above provide an overview of the instructional use of computer, video, and audio technologies. More detail on the Minnesota data can be found in Minnesota Higher Education Coordination Board, Report on the Findings of the Information Technology Survey of Instructional Uses in Post-Secondary Education in Minnesota (June 1986). Findings from the WICHE survey of 13 western states can be found in Western Interstate Commission for Higher Education, Instructional Applications of Information Technologies: A Survey of Higher Education in the West (July 1985). The CPB study final report was

released in September, see Corporation for Public Broadcasting, Instructional Technology in Higher Education: A National Study of Educational Users of Technology in American Colleges and Universities (May 1986).

The following chapter reviews findings of obstacles to use and issues in the use of information technologies.

CHAPTER IV. INFORMATION TECHNOLOGY IN INSTRUCTION: FINDINGS REGARDING OBSTACLES AND ISSUES

While the availability and use of information technologies are growing nationally and in Minnesota, several obstacles remain and many issues need to be addressed. This chapter discusses the main obstacles and issues identified during this project.

The HECB survey was designed to delineate issues and obstacles. The majority of the respondents were administrators who addressed questions concerning obstacles to the effective use of information technologies, funding, courseware development, potential areas of collaboration among institutions, and future plans.

OBSTACLES

In response to the HECB survey, the administrators indicated that the most troublesome obstacles to effective use of information technology for instruction are:

- Inadequate financial resources to obtain necessary hardware and software.
- Lack of courseware available that meets the institution's academic needs and standards.
- Logistical complexities involved in supporting students learning off-campus via technology. These findings are shown on Table 5.

TABLE 5: OBSTACLES TO MORE EFFECTIVE USE OF INFORMATION TECHNOLOGIES

Obstacles	Number of Institutions (N = 91 Institutions)
Inadequate Financial Resources	70
Lack of Coursevare	45
Logistical Complexities	38
Inadequate Rewards and Incentives	24
Inadequate Advice and Support	18
Inadequate Information/Applications	13
Inadequate Knowledge/Policy makers	11
Inadequate Cooperation/Broadcasters	6
Inadequate Cooperation/Cable	6

SOURCE: Higher Education Coordinating Board, Survey of Instructional Uses in Post-Secondary Education in Minnesota (June 1986).

These problems are compounded by the lack of qualified personnel, such as technical support staff, maintenance personnel, and faculty experienced in using information technology in the classroom, according to the open-ended questions in the HECB survey. Other constraints were reflected in complaints about inadequate facilities and computer labs and high cost of equipment and broadcast time.

ISSUES

In addition to the predominant cost issue, this chapter addresses issues of faculty development, courseware, networks for sharing and potential areas for collaboration, planning, regulation of distance learning, and intellectual property rights.

Costs

Cost is a prevalent issue both nationally and statewide. In Minnesota, except for a super-computer and mainframes, minicomputers and other instructional technology are designated as an operating expense rather than a capital expense. Operating expenses, supported by enrollment-driven funding formulas, must cover these hardware acquisition costs, software, and the remaining costs of materials and support personnel. These costs are not particularly enrollment sensitive. Experience shows that the appetite for use expands rapidly as computer equipment and networks are made available. Administrators are under pressure to allocate more funds for information technology.

The CPB survey, conducted in 1984-1985, indicated that most institutions rely on reallocation of general operating funds as funding sources with an expected increase of over 40 percent in the next

fiscal year. Rising expectations by both faculty and students for access to technology, uncertain state funding, and faculty development needs and incentives are a few of the reasons for such emphasis on costs.

There are precedents for state funding for information technology in Minnesota. Since 1983, appropriations for elementary and secondary public education have included funding for planning, faculty development, courseware development and evaluation, technology demonstration sites, and state agency leadership. In the post-secondary sector, however, there have been relatively few recent special appropriations other than the supercomputer at the University of Minnesota and library automation for the community colleges and state universities.

Other mechanisms have provided funding support, for example:

- o internal shifts.
- o additional tuitions, surcharges, or technology fees.
- o faculty and student purchase of hardware at reduced prices through the post-secondary institution.
- o user fees.
- o external sources, such as contracts, gifts, foundation grants, federal grants.

Reallocation of internal resources is a legitimate expectation. In today's environment, however, innovative strategies and plans will be needed to meet the expectations of a variety of internal and external constituencies.

Faculty Development

Faculty development is not only a state issue. Nationally, the quality and quantity of faculty training for use of technology is inadequate and insufficient. In Minnesota, 25 percent of the surveyed institutions offered half or more of their faculty special orientation

or training in the use of technology. Most offered less than one-fourth of their faculty training.

The national CPB survey identifies three areas of incentives for faculty:

- o actual training in use of technology.
- o technical support.
- o financial assistance for purchase of equipment.

Two-thirds of the post-secondary institutions surveyed by CPB offer some computer training, and about half provide expert assistance in using a computer, with a substantially higher number in technical support for video. The HECB survey shows Minnesota's institutions having higher numbers in technical support for faculty who use computers than for those who use audio and video.

According to the HECB survey, the main incentives to encourage technology use are training and easy access to video or computer work stations. There are almost no career incentives, such as promotion and tenure policies, to reward such time-consuming endeavors.

There are some bright spots in Minnesota, particularly in the State University System where a three year Bush Foundation grant is funding extensive training of faculty in instructional computing applications. However, according to Lewis, unless more emphasis is placed on special incentives or rewards to encourage faculty, few will get involved in the use of information technologies for instruction.11 These increased incentives must overcome the faculty attitude that technology is merely a supplement to content presentation and a

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11 Ray Lewis, keynote speaker, Dissemination Conference on Information Technology, Higher Education Coordinating Board (June 10, 1986).

time-consuming supplement at that, particularly in the selection, evaluation, or development of courseware and in the logistical problems of bringing the technology to the students or the students to the technology.

Courseware

Not only are the incentives and rewards for faculty use of information technologies few, but the commercial courseware actually available often does not meet the academic standards of the institutions. Also, if institutions share terminals, software, telecommunications, networks, and purchasing agreements for existing courseware, there are issues of ownership, protection of intellectual property rights, priority use of specialized services (such as, high speed computation), licensing, and price and control of usage as outlined in a report on strategies for information processing by the University of Wisconsin.12

Another major issue is the quality of courseware. The HECB survey shows a highly critical attitude toward the quality of courseware, particularly of computer software. This lack of courseware that meets academic needs and standards of an institution is rated as the second largest obstacle to use of information technologies. Two factors that create this problem are low faculty interest in development of courseware and high costs of producing courseware. Institutions can increase incentives or provide technical support so that courseware is designed under the faculty member's guidance, thus lessening the need for

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12 University of Wisconsin System, "Strategies for Information Processing" (April 6, 1985).

intensive faculty training. Commercial production, on the other hand, is plagued by high production costs, a fragmented market, and institutional copying of commercial programs, according to Robert O'Dell, Director of Software Publishing, EMS/McGraw Hill.13 Site licensing and software designed to supplement a specific text series might help alleviate some of these disincentives for commercial vendors.

Networks and Potential Areas for Collaboration

The HECB survey indicates that most post-secondary institutions in Minnesota are not participating in consortia or networks for sharing the use of technology. Policies that encourage collaborative use of information technologies by numerous institutions were not considered a high priority by respondents. However, several initiatives in Minnesota could increase both interest and participation in networks and consortia. The Minnesota Department of Transportation, for example, is planning to upgrade its data transmission system. This could provide an opportunity for post-secondary education networks. Several vocational-technical institutes, community colleges, and state universities in rural Minnesota are exploring the possibility of linking and sharing two-way interactive video capabilities with public school districts designated as technology demonstration sites by the Minnesota Department of Education.

Minnesota is lower than the national average in consortia/network participation at the local, state, and national levels, according to the CPB survey. This does not mean, though, that Minnesota post-sec-

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13 Robert O'Dell, speaker, Dissemination Conference on Information Technologies, Higher Education Coordinating Board (June 10, 1986).

ondary education is not interested in collaborative efforts. According to the HECB survey, the most important area for potential collaboration is sharing information with other educators who are using information technologies, rather than shared purchase or use of courseware. Most institutions belonging to networks or consortia are interested in two-way interactive video or computers.

Although an overview of state-wide telecommunications presents a fractured picture, there are significant advances in some areas. Library systems have been an admirable model of cooperation and collaboration. The vocational-technical institutes and community colleges have installed a network of satellite down links for state-wide and nation-wide teleconferencing. The University of Minnesota has installed a sophisticated telephone system which integrates data communication. A fiber optic backbone network will provide access to several supercomputers as well as mainframe computers. Most networks within post-secondary institutions are on a single campus rather than among campuses, with plans to upgrade campus-wide networks. The integration of technologies on a state-wide basis is a formidable challenge.

Planning

There is a need for strategic planning for information technologies in hardware, software, and communications. Emery highlights five keys to effective planning:

- o anticipating future needs in order to take purposeful short-term action.
- o organizing problem solving efforts.
- o positioning the organization to gain a strategic competitive advantage.
- o preserving options.
- o mustering sustained support from the "stakeholders."14

The University of Wisconsin report cited above underscores the need to look toward the future by creating a framework to determine the nature and direction of institution use as well as by continually updating and re-evaluating plans and initiatives.

Regulation of Distance Learning

In 1985 Project ALLTELL, a joint study by the State Higher Education Executive Officers Association and the Council on Post-Secondary Accreditation, outlined five major areas of concern for the regulation of long distance learning:

- o Developing applicable policies, criteria and procedures for accrediting and authorizing telecommunications-based long distance programs and institutions to ensure and encourage basic consumer protection, quality, quality enhancement, and integrity of the educational activities.

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14 James Emery, "Issues in Building an Information Technology Strategy," EDUCOM Bulletin (Fall 1984).

- o Encouraging effective institutional, agency, or organizational self-regulation and quality development as movements are made into the area of long distance telecommunications-based educational programs and degree delivery.

- o Encouraging states to develop and adopt more uniform and complementary authorization laws and procedures that include reasonable provisions related to telecommunications-based long distance learning.

- o Exploring and addressing the legal issues involved in and for states, accrediting associations, and institutions and organizations concerned with or involved in telecommunications-based distance learning.

- o Addressing current and future telecommunications developments as they may impact the issues of authorization, accreditation and institutional self-regulation. 15

Several states have already endorsed these steps to develop legislation for regulating distance learning. Minnesota has taken the first step in addressing this issue. Chapter 136A.61 (1975), the Private Institution Registration Act, clearly defines policy for private colleges concerning this issue, with specific reference to public institutions in other states:

> The legislature has found and hereby declares that the availability of legitimate courses and programs leading to academic degrees offered by responsible private institutions of post-secondary education and the existence of legitimate private colleges and universities are in the best interests of the people of this state. The legislature has found and declares that the state can provide assistance and protection for persons choosing private institutions and programs, by establishing policies and procedures to assure the authenticity and legitimacy of private post-secondary education institutions and programs. The legislature has also found and declares that the same policy applies to any public post-secondary educational institution located in another state or country which offers or make available to a

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15 Bruce N. Chaloux, Project ALLTELL: Assessing Long Distance Learning via Telecommunications. Council on Post-secondary Accreditation, State Higher Education Executive Officers Association (October 1985).

Minnesota resident any course, program or educational activity which does not require the leaving of the state for its completion.

This issue is not clear-cut. Few institutions in the HECB survey mentioned regulation as an area of immediate concern. However, if an increased number of institutions develop courses to be delivered to other institutions either in-state or out-of-state, regulation of this learning could become a key issue. Of equal interest to the Coordinating Board is the potential of instruction by telecommunications to improve access to educational programs for Minnesota citizens.

Intellectual Property Rights

The issue of intellectual property rights has become extremely confusing and complex. Originally the law which governed patents, copyrights, and trademarks was simple: property rights were granted specifically to the author or inventor. Now computers, two-way interactive cable, and satellites have created problems in clearly defining intellectual property. The rapid proliferation of technology, particularly in combination, has outpaced the ability of the legal structure to accommodate the changes. Protecting the rights of software designers and producers, information analysts, and manufacturers of equipment capable of copying, reproducing or recording (e.g., satellite antennas, video cassettes, and audio tapes) is a major problem that affects education in such areas as development and

use of courseware and reception of programs from other institutions. The legal system is hard pressed to keep up with the complexity of intellectual property questions caused by rapidly changing technology.16

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16 U.S. Congress, Office of Technology Assessment, Intellectual Property Rights in an Age of Electronics and Information, OTA-CIT-302. Washington, D.C.: U.S. Government Printing Office (April 1986).

CHAPTER V. IMPLICATIONS FOR STATE POLICY

The legislative mandate to the Higher Education Coordinating Board instructed it to "initiate activities to coordinate state policy development regarding the use of information technology in post-secondary education —— and provide opportunities for post-secondary education policymakers to review issues and needs for policy development." The previous chapters presented the findings of the project and the issues that were identified. This chapter discusses state policy options that would address the issues. These options are intended to express the state's commitment for and its expectations for the use of technology in post-secondary education while recognizing the primary role of the post-secondary education systems and institutions in setting their policies.

Broad support exists for learning more about — and doing more with -- technology in education. Students, parents, industry, government, and educators believe that technology should be actively integrated into learning activities. A workforce familiar with and trained in the use of technology can contribute to the state's economic vitality. The cost of technology in education, however, is a concern to administrators and policy makers. The rapid expansion of the use of technology is forcing reallocation of resources and raising questions of access to important educational tools.

Findings from the HECB Information Technology Project indicate that:

- o There is considerable interest and activity in use of technology in Minnesota's post-secondary institutions.
- o There are considerable differences between institutions in their expertise and use of technology.
- o There is a need for formal, comprehensive planning at the institutions if the use of technology is to be expanded and what is available is to be effectively used.
- o There is a need for resources to support faculty development programs in the use of technologies.
- o There is a need and desire to share and collaborate in the expertise and use of technology.
- o There is an opportunity to build linkages between resources in post-secondary education institutions, public school systems, other government agencies and industry.

OPTIONS

Options listed below should be seen in a context of an activist role for state policy which has been the history in Minnesota. The literature regarding technology is sparse in exploring state level policy and actions. The literature has been searched, other states have been surveyed, and discussions held with informed persons. The options assume that use of technology in instruction has reached a plateau and that additional initiatives will be needed to increase use and effectiveness of technology.

Funding

The issue. Costs of technology are not particularly related to enrollment increases or decreases. The appetite for use expands rapidly as computer equipment and networks are made available.

Administrators are under pressure to allocate more funds for information technology, including hardware, software, maintenance, and staff support. Rising expectations by both faculty and students for access to technology, uncertain state funding, and faculty development needs and incentives are a few of the reasons for emphasis on costs.

Policy options. Possible approaches to funding include the following:

- o Internal reallocation to support acquisition and technical personnel.
- o Incentive and/or competitive grants to stimulate individual faculty members, departments or institutions to introduce new technologies, and cover start-up costs.
- o User fees or tuition surcharges.
- o Special appropriations for technology acquisition and support services.

Faculty Development

The issue. In Minnesota, less than one-sixth of the institutions offer a significant level of special orientation or training. Most reported offering less than one-fourth of its faculty training. Faculty development, however, is seen as a key need. Rather than rely on "canned" presentations for use of existing hardware and software, what is needed is the development of special courses that can be individualized to meet the needs of particular discipline areas.

Policy options. Ways to promote faculty development could include the following:

- o Incentive grants available to systems, to institutions, and to academic discipline associations to develop high quality, discipline specific faculty development programs.
- o Recognition and support of faculty who are making effective use of technology.
- o Establishment of a state center for support of faculty training materials, inter-system sharing, and technical assistance.

Courseware

The issue. The lack of courseware available that meets academic needs and standards of an institution is rated the second largest obstacle to effective use of information technologies, behind funding. Two factors that create this problem are low faculty interest in developing courseware and the high costs of producing courseware. Commercial production is plagued by high production costs, a fragmented market, and institutional copying of commercial programs rather than purchasing additional packages from the commercial vendor.

Policy options. Alternatives to address this issue include the following:

- o Do nothing and expect the market place (commercial development) to satisfy the demand over time.
- o Review tenure and promotion policies to recognize the intellectual and instructional value of courseware that meet scholarly criteria.
- o Establish a state center for encouraging courseware development, evaluation, distribution, and preview and to maintain a central data base on instructional support software available from external and internal sources.
- o Identify and collaborate with national efforts to improve courseware quality and distribution.

- o Aggressively pursue site licensing and volume purchasing agreements.

Intellectual Property Rights

The issue. Originally the law which governed patents, copyrights and trademarks was simple: property rights were granted specifically to the author and inventor. Now, technology, including computer, two-way interactive cable, and satellite, has created problems in clearly defining intellectual property. Protecting the rights of software designers and producers of telecommunications transmissions is a major problem that affects development and use of educational courseware and reception of programs from other institutions.

Policy options. Options are as follows:

- o Recognize that the federal government has responsibility in this area.
- o Have explicit system and institutional policies and guidelines governing staff and student behavior regarding copying of materials.

Statewide Telecommunications Network

The issue. Demand for electronic communications links between communities, campuses, and state facilities is growing. The demand is for administrative data transmission, information base sharing, library collection sharing, and two-way interactive conferencing and instruction. Deregulation of the telephone industry has produced uncertainty over the cost of transmission. Technology now in place is unlikely to meet the burgeoning demand.

Policy options. Possible approaches to meet this demand include:

- o Collaborative study and action among state agencies and the higher education systems to promote sharing of resources and development costs of expanded capacity.

- o Exploration with the private sector of an expanding communication networks using fiber optic cable to reach major state communities.

Regulation of Distance Learning

The issue. Long distance learning via technology enables institutions to offer educational programs originating outside the state to citizens anywhere in the state. Developing applicable policies, criteria, and procedures for accrediting and authorizing telecommunications - based long distance programs and institutions to ensure and encourage basic consumer protection is a statutory responsibility of the Coordinating Board.

Existing statute regulating private institutions provides adequate authority to meet concerns. Existing Coordinating Board policies and procedures appear to be appropriate and adequate.

Collaboration Between and Among Institutions and Faculty

The issue. The cost of supporting technology, the rapidly changing nature of hardware and courseware, and the decentralized nature of post-secondary education create special problems in effective and efficient use of technology for instruction. Findings indicate a desire for collaboration in acquiring and using hardware and data bases, sharing courseware and expert knowledge, and sharing knowledge about special programs existing in other institutions, public schools, and industry. Communications and decision patterns are specific to institutions and systems with few incentives or opportunities to make contact with nearby institutions.

Policy options. Options include the following:

- o Provide resources to initiate state conferences, newsletters and other initiatives to share information and provide forums for special interest sharing.
- o Establish a capacity in regional centers with responsibility to build an infrastructure of activities and networks to promote collaboration and sharing of resources and expertise.

Planning

The issue. The integration of information technologies into the fabric of institutions is critical for educational excellence and the economic vitality of the state. Because this is a rapidly, constantly changing field and a costly one, it is difficult to estimate ongoing costs, to keep up with needs and developments on campus, and to be aware of resources available in other institutions and the community. The missions of institutions differ so their need for and use of technology will differ.

Institutional planning is a first step to focus the attention and give direction to the use of information technology for instructional purposes.

Policy options. Ways to enhance planning include the following:

- o Provide incentives for institution planning efforts.
- o Provide state technical assistance capacity.

CONCLUSION

For the past several years state government has supported policies to encourage and promote the use of information technology for instruction. As a result of legislative initiatives in 1983, Minnesota has become a national leader in the use of technology in public schools.

Minnesota now has an opportunity to become a leader in technology for post-secondary education. Significant use of technology already is occurring as a result of special legislative appropriation and internal reallocations by institutions and systems. Projects such as the super computer capacity at the University of Minnesota and system-wide library automation among the state universities and the community colleges have received national attention. Continued achievement will require an integrated package of policies and significant resources.

Experience from the 1983 initiatives for the public schools, the recommendations of the Commission on the Future of the Post-Secondary Education, and the findings of this study form the basis for policy initiatives that can contribute to the state's educational and economic development goals. Such initiatives would support:

- Institutional planning for the use of technology in instruction with resources available for first step implementation of plans.
- The development of regional infrastructures to support shared use of resources, collaborative actions, and special programs to support the institutions and public schools in acquiring and effectively using of the new technologies.
- The establishment of centers of excellence to serve the special needs of post-secondary education in areas of faculty development, courseware development and evaluation, telecommunications, and teacher training for technology.
- A central capacity to provide leadership and planning assistance to the effort.

APPENDICES

- Glossary of Terms
- Funding of Computer Infrastructure
- Survey Questions

APPENDIX A. GLOSSARY OF TERMS

VIDEO TECHNOLOGIES

Cable: Cable television transmits the signal to a television receiver directly through the air waves (microwave), coaxial cable, or fiber optics. Its principal advantages are better reception, the ability to direct specific signal to specific receivers, and more channels for use.

Close Circuit Television: A transmission system that distributes television programs, live or tape, both audio or video, to a limited network connected by cable. The telecast cannot be received by other television sets outside the selected network.

Fiber Optics: A medium for transmitting audio, video, and data through a network of glass fibers.

Instructional Television Fixed Service (ITFS): A number of channels in the 2,500,000,000 Hertz band which provide television opportunities for educational purposes. It is a low-powered, limited range system which is less costly than a very high frequency and ultra high frequency installations for transmitting programs. Its signals are private because home television sets cannot receive them; as an institution must have a special receiving system (translator) to convert the ITFS signal for distribution on closed-circuit channels.

Satellite: A technology which utilizes an earth station (satellite dish) to receive signals from communication satellites orbiting the earth. A downlink system only receives signals and an uplink system can send signals to the communications satellite for transmission anywhere on earth.

Videodisc: A disk, usually plastic, on which are recorded video and/or audio signals for television use. This technology also can store large amounts of data and programs. It requires a compatible videodisc player.

Video Cassette: Also called video tape, this technology is a magnetic tape on which video and audio signals are recorded for television use.

Teleconferencing: A technique that can use a variety of information technologies such as satellite, two-way interactive cable, or telephone linkages, that allows individuals or groups at different locations to participate in a larger group conference.

AUDIO TECHNOLOGIES

Radio, AM: A radio receiver which uses a propagation and transmission system in which the amplitude (intensity), not the frequency, of the carrier wave is modulated. AM broadcasting is not restricted by line of sight transmission as is FM.

Radio, FM: A radio receiver which uses a propagation and transmission system in which the frequency, not the amplitude, of the carrier wave is modulated.

Public/Commercial Radio: Public radio is primarily a sponsor and patron-supported programming system; commercial radio is support by advertisement fees.

Audio Cassette: A magnetic tape in a cartridge on which are recorded electrical signals which can be covered to reproduce sound.

Facsimile: The transmitted product of a facsimile transmission in which pictures or prints are transformed into electrical signals to be transmitted and recorded in the manner of television, except very much more slowly, and needing a very much narrower bandwidth for transmission than television. The output of the system is hard copy.

COMPUTER

Computer-Assisted Design: A computer program with graphics capabilities oriented to business information management and presentation of educational materials applications. It is used as a design tool by increasing the numbers of manufacturing and service industries.

Computer-Assisted Instruction: An instructional technique based on the two-way interaction of a learner and a computer which can emphasize drill and practice, dialogue, inquiry, problem-solving, simulation and gaming, and tutorial methods.

Computer-Based Instruction: Similar to CAI, but emphasizes individualization and the computer as sole instructor.

Computer-Managed Instruction: Use of computer in education, not for instruction, but for recording the progress of a student through a learning sequence, prescribing lessons for the student, grading tests, scheduling non-computer learning experience, and making all this data available to both student and faculty.

Electronic Mail: Messages sent to and from computer of videotext terminals linked by telephone lines.

Gaming: An educational technique in which the student is presented with a situation involving choice and in which there are different risks; customarily, the choices are made in a simulated real-life situation and the situation changes dynamically as influenced by the choices, which then produce some sort of pay-off, such as a reward or deprivation, dictated by either chance or by choice of strategies made by the student.

Modeling: An activity often used for instruction in speech which the student listens to and observes a model as a basis upon which to practice and improve his/her performance.

On-line Data Base Searches: A comprehensive collection in usable form of information of any type, usually used to refer to information in a machine-readable, machine-searchable form.

On-line Library Catalog Searches: A list of material or items arranged in some definite order; it records, describes, and indexes the resources of a collection, a library/learning resources center, or a group of such agencies.

Simulation: Learning process which involves the student as a participant in role representations and/or games simulating real-life situations or environments.

APPENDIX B. FUNDING A COMPUTER INFRASTRUCTURE IN HIGHER EDUCATION

Presented by Dr. Barbara Wolfe, Assistant Vice President for Information Systems, University of Minnesota, at Dissemination Conference on Information Technology, Minnesota Higher Education Coordinating Board, June 10, 1986.

FUNDING
A
COMPUTING INFRASTRUCTURE
IN
HIGHER EDUCATION

(Outline)

BARBARA B. WOLFE
ASSISTANT VICE PRESIDENT FOR INFORMATION SYSTEMS
UNIVERSITY OF MINNESOTA
Minneapolis, MN 55455

REQUIREMENTS FOR COMPUTING INFRASTRUCTURE

- HARDWARE
- SYSTEM SOFTWARE
- MAINTENANCE OF HARDWARE AND SYSTEM SOFTWARE
- COMMUNICATION AMONG SYSTEMS (MOVING BITS)
- APPLICATION SOFTWARE
- FACULTY AWARENESS AND ACCEPTANCE
- FACULTY SKILLS FOR USE OF SOFTWARE
- FACULTY SKILLS FOR SOFTWARE DEVELOPMENT
- MANAGING SOFTWARE DEVELOPMENT
- MAINTENANCE OF DEVELOPED SOFTWARE
- ESTABLISHING THE INSTITUTIONAL REPOSITORY
- DISSEMINATION OUTSIDE THE INSTITUTION

COSTS FOR COMPUTING INFRASTRUCTURE

- **HARDWARE ($1,000 ----> $10,000,000)**
  - Vendor Supplied
  - Purchased with Discount
  - Shared Use of Remote Facilities
- **SYSTEM SOFTWARE ($0 ----> $250,000 /yr)**
  - Vendor Supplied with Hardware
  - Purchased with Discount
  - Purchased from Third Party
  - Written by Staff of Institution
- **MAINTENANCE OF HARDWARE & SYSTEM SOFTWARE ($100/yr-->$1,000,000 /yr)**
  - Warranty Period -- Free
  - Vendor Supplied for Monthly/Annual Fee
  - Purchased from Third Party for Monthly/Annual Fee
  - Performed by Institutional Staff in Conjunction with Vendor Liaison
- **COMMUNICATION AMONG SYSTEMS ($50 / port ----> $2,000 / port)**
  - Cable and Wiring Plant
  - Hardware and Software for Sending and Receiving Signals
  - Maintenance of Above (Contracts or Staff)
- **APPLICATION SOFTWARE ($0 ----> $250,000/yr)**
  - Vendor Supplied
  - License from Vendor for One Time Monthly/Annual Fee
  - License from Third Party for One Time Monthly/Annual Fee
  - Obtain from Colleague
  - Write -- Staff Commitment
- **FACULTY AWARENESS AND ACCEPTANCE (? $50 / hour)**
  - Development Programs for Faculty
  - Recruiting
  - Incentives

- **FACULTY SKILLS FOR USE OF SOFTWARE (? $50 / hour)**
  - Development Programs for Faculty
  - Private Access to Hardware and Software
  - Faculty Time
- **FACULTY SKILLS FOR SOFTWARE DEVELOPMENT (? $50 / hour)**
  - Development Programs Teaching Computer Programming
  - Private Access to Hardware and Software
  - Faculty Time
  - Managing and/or Communicating with Programming Support Staff
  - Managing and/or Communicating with Instructional Design Support Staff
- **MANAGING SOFTWARE DEVELOPMENT (? $50 / hour)**
  - Management Skills
  - Standards, Procedures, and Practices
  - Documentation at All Levels
- **MAINTENANCE OF DEVELOPED SOFTWARE (? $35 / hour)**
  - Changes When Hardware and Systems Change
  - Fixing of "BUGS"
  - Adding Enhancements and Improvements
  - Deleting Obsolete Code
- **ESTABLISHING THE INSTITUTIONAL REPOSITORY (?)**
  - Traditionally Library -- Now Electronic Library
  - Cataloging and Retrieving
  - Backup
  - Security
  - Royalties
- **DISSEMINATION OUTSIDE THE INSTITUTION (?)**
  - Traditionally Publishing -- Now Electronic Publishing
  - Storage and Transmission
  - Royalties

SOURCES FOR FUNDING COMPUTING

- STUDENTS
  - Fees for Usage
  - Surcharge on Tuition
  - Increase in Tuition
  - Purchase
- STATE
  - General Revenue Based
  - Specific Revenue Based
  - Matching Formulas
- FEDERAL
  - Research Grant Programs
    - Explicit
    - Implicit (Overhead)
  - Improvement of Teaching Programs
  - Contracts
- INDUSTRY
  - Gifts
  - Gifts for In-Kind Development
  - Grants Programs -- Research Relationship for Principal Investigator and Institution
  - Contracts -- Deliverables to Industry
  - Institutes
- PRIVATE GIFTS
  - Use of Endowment
  - Financing Arrangements
  - Matching Programs

APPENDIX C. SURVEY QUESTIONNAIRE

The Minnesota Higher Education Coordinating Board made several changes and amendments to the original survey constructed by the Western Interstate Commission for Higher Education (WICHE) in 1984. The original single document was expanded to three forms.

INS = Institution used as a referent. Designated for private colleges, community colleges, and state universities.

UM = The referent "college: is submitted for "institution." Designated for the University of Minnesota, Twin Cities campuses. An addendum was included that addressed the question of direct central funding support for computers in the areas of instruction, research, administration, and telecommunications (voice and data).

AVTI = Institution used as referent, but curriculum choice different (Question 3.B). Designated for the Area Vocational Technical Institutes. An addendum was included that addressed the current use of specific technologies, such as downlink satellite and regular telephone.

October 1985

INFORMATION TECHNOLOGIES

Survey of Instructional Uses

In Post-Secondary Education in Minnesota

MINNESOTA HIGHER EDUCATION COORDINATING BOARD

This survey is about the use of video, audio and computer technologies in the delivery of post-secondary education coursework by your college or institution. The Higher Education Coordinating board is gathering information for the purpose of determining opportunities for coordinated planning, collaboration, networking, and mutual support. Even though the information requested may not be readily available, you are asked to approximate answers where actual statistics are not available. There are five sections: 1) Institutions, 2) Information Technologies, 3) Instructional Applications, 4) Factors Affecting the Use of Information Technologies, and 5) Special Features and Plans. Please mark the most accurate choice (x) in sections 1-4 and provide the requested information in section 5. You are encouraged to add information or amplify your answers wherever it is necessary. Add sheets to the survey and number your additions to correspond with the number of the question (e.g. 2.A.21). The summary of the results will be distributed to all institutions who complete the survey.

Definitions of some terms used in the survey:

Consortium (formal): a contractual collaborative relationship between two or more organizations.

Consortium (informal): an ongoing non-contractual collaborative relationship between two or more organizations.

Courseware: the print and electronic media components of instruction delivered by video, audio, or computer technology.

Information technology: a general term used in this survey to refer to all audio, video and computer technology.

Network: a general term used to refer to two-way communications among educators via electronic or conventional means.

Telecourse: a combination of print and electronic video or audio components that are assigned to provide a student with the equivalent of a regular classroom-based course. Texts and student study guides are generally accompanied by roughly 10-15 hours of video or audio instruction and some classroom experience.

Adapted from the Western Interstate Commission for Higher Education (WICHE), 1985. Copyright WICHE, 1984. All rights reserved.

Information Technologies:
Survey of Instructional Uses in Higher Education

Institution HEGIS CODE: _____

A. Name: _____

B. Type and level of institution. Highest level offered is (Mark one):

		Public	Private
1.	Two year (but less than 4)	1. ___	___
2.	Four- or five-year baccalaureate	2. ___	___
3.	Master's or beyond master's but less than doctorate	3. ___	___
4.	Doctorate	4. ___	___

Information Technologies

A. Does your institution use any of the following video techniques to delivery instruction to learners either on-campus or off-campus? (Mark all that apply.)

			On	Off
1.	None	1. ___		
2.	Broadcast TV, public	2.	___	___
3.	Broadcast TV, commercial	3.	___	___
4.	Cable TV, one way	4.	___	___
5.	Cable TV, interactive	5.	___	___
6.	Instructional Television Fixed Service (ITFS)	6.	___	___
7.	Point-to-point microwave	7.	___	___
8.	Slow-scan, freeze-frame TV	8.	___	___
9.	Video cassette	9.	___	___
10.	Videodisc	10.	___	___
11.	Closed circuit TV	11.	___	___
12.	Satellite-receive	12.	___	___
13.	Satellite-send	13.	___	___
14.	Videotext	14.	___	___
15.	Teletext	15.	___	___
16.	Video teleconferencing	16.	___	___
17.	Video teleconferencing (two-way video)	17.	___	___
18.	Low power TV	18.	___	___
19.	Direct Broadcast TV	19.	___	___
20.	Fiber Optics	20.	___	___
21.	Electronic Blackboard	21.	___	___
22.	Other	22. ___		

B. Does your institution use any of the following audio technologies to deliver instruction to learners either on-campus or off campus? (Mark all that apply.)

		ON	OFF
1.	None	1. ___	
2.	AM Radio	2. ___	___
3.	FM Radio, public	3. ___	___
4.	FM Radio, commercial	4. ___	___
5.	SCA Radio	5. ___	___
6.	Cable Radio	6. ___	___
7.	Audio Cassette	7. ___	___
8.	Audio teleconferencing	8. ___	___
9.	Regular telephone service	9. ___	___
10.	Audiographics	10. ___	___
11.	Facsimile	11. ___	___
12.	Radio talkback	12. ___	___
13.	Other	13. ___	

C. Does your institution use any of the following computer applications to deliver instruction to learners either on-campus or off-campus? (Mark all that apply.)

1.	None	1. ___	
2.	Computer-assisted Instruction (CAI)	2. ___	___
3.	Computer-managed Instruction (CMI)	3. ___	___
4.	Computer-based instructional management (CBIM)	4. ___	___
5.	Computer-assisted design (CAD)	5. ___	___
6.	Computer-based training (CBT)	6. ___	___
7.	Computer conferencing	7. ___	___
8.	Electronic mail	8. ___	___
9.	Simulation/gaming	9. ___	___
10.	Modeling	10. ___	___
11.	On-line data base searches	11. ___	___
12.	On-line library catalog searches	12. ___	___
13.	Other Services	13. ___	___

D. Does your institution use any of the following computer hardware to deliver instruction to learners other than computer science students? (Mark the degree of such use: ? = don't know, 0 = none, L = low, M = medium, H = high.)

		?	O	L	M	H
1.	Main-frame computers	1.	___	___	___	___
2.	Minicomputers	2.	___	___	___	___
3.	Microcomputers (stand alone)	3.	___	___	___	___
4.	Microcomputers (networking)	4.	___	___	___	___
5.	Time-sharing terminals	5.	___	___	___	___
6.	Other 6. ___					

E. Of the microcomputers used by faculty and students for instructional purposes at your institution, approximately what percentage fall into the following categories?

			Percent					
	?	None	1-10	11-20	21-30	31-40	41-50	50+
IBM PC (and compatibles)	___	___	___	___	___	___	___	___
Apple II series	___	___	___	___	___	___	___	___
Apple Macintosh	___	___	___	___	___	___	___	___
Zenith	___	___	___	___	___	___	___	___
Control Data Corporation	___	___	___	___	___	___	___	___
Texas Instruments	___	___	___	___	___	___	___	___
AT&T	___	___	___	___	___	___	___	___
Radio Shack	___	___	___	___	___	___	___	___
Commodore	___	___	___	___	___	___	___	___
Other	___	___	___	___	___	___	___	___

F. Does your institution make use of any of the following combinations of technologies in order to delivery instruction? (Mark all that apply.)

1.	Broadcast or cable TV/audio teleconferencing	1.	___
2.	Broadcast or cable TV/audiotape	2.	___
3.	Broadcast or cable TV/radio	3.	___
4.	Audio teleconferencing/videotape	4.	___
5.	Audio teleconferencing/slides overheads	5.	___
6.	Audio teleconferencing/slow-scan tv	6.	___
7.	Audio teleconferencing/facsimile	7.	___
8.	Audio teleconferencing/videotext	8.	___
9.	Audio teleconferencing/electronic mail	9.	___
10.	Audiotape/telephone	10.	___
11.	Radio/telephone	11.	___
12.	Computer/videotape	12.	___
13.	Computer/videodisc	13.	___
14.	Computer/cable TV	14.	___
15.	Computer/broadcast TV	15.	___
16.	Computer/audiotape	16.	___
17.	Computer/telephone	17.	___
18.	Computer/facsimile	18.	___
19.	Other 19. ___		

G. Does your institution have an ongoing formal (contractual) or informal working relationship with a local or state public television agency? (Mark one)

1. Don't know ___
2. No ___
2. Formal (contractual) ___
4. Informal ___
5. Institution is licensee ___

H. Does your institution have an ongoing formal (contractual) or informal working relationship with a local or state public radio agency? (Mark one)

1. Don't know ___
2. No ___
2. Formal (contractual) ___
4. Informal ___
5. Institution is licensee ___

I. Does your institution participate in any information technology networks or consortia? (Mark one)

1. No (Mark and proceed to question 3A)
2. Yes (Mark and proceed to 2I and 2J)

J. Does your institution participate in any of the following types of networks or consortia? (Mark all that apply: L - local, S = statewide, N = national.)

		L	S	N
1.	Radio network	1. ___	___	___
2.	Boradcast video network	2. ___	___	___
3.	Non-broadcast video network	3. ___	___	___
4.	Audio teleconferencing network	4. ___	___	___
5.	Computer network	5. ___	___	___
6.	Cable television consortium	6. ___	___	___
7.	Video telecourse consortium	7. ___	___	___
8.	Video teleconferencing consortium	8. ___	___	___
9.	Other	9. ____		

K. Please indicate the name (or acronym, if well known) of any formal (contractal) or informal collaborate efforts in which your institution participates with other institutions or organizations to delivery insruction via information technology.

_____
_____
_____
_____
_____
_____

Instructional Applications

A. For what instructional purpose does your institution use video, audio, or computer technologies? (Mark degree of such use: ? = don't know, 0 = none, L = low, M = medium, H = high.)

			?	O	L	M	H
1.	Lower division undergraduate	1.					
2.	Upper division undergraduate	2.					
3.	Vocational/technical education	3.					
4.	Graduate education	4.					
5.	Professional continuing education	5.					
6.	Adult continuing education	6.					
7.	Adult basic education	7.					
8.	Public service programming	8.					
9.	Education/career information	9.					
10.	Counseling	10.					
11.	Assessment	11.					
12.	Other	12.					

B. Which curriculum areas make heaviest use of video, audio, and computer technologies at your institution. (Mark the degree of use for each technology - video, audio and computer. ? = don't know, 0 = none, L = low, M = medium, H = high.)

			?	O	L	M	H
Video							
1.	Social Science	1.					
2.	Humanities	2.					
3.	Physical and biological sciences	3.					
4.	Computer science	4.					
5.	Math	5.					
6.	Business	6.					
7.	Engineering	7.					
8.	Medicine	8.					
9.	Law	9.					
10.	Other	10.					

			?	O	L	M	H
Audio							
1.	Social Science	1.					
2.	Humanities	2.					
3.	Physical and biological sciences	3.					
4.	Computer science	4.					
5.	Math	5.					
6.	Business	6.					
7.	Engineering	7.					
8.	Medicine	8.					
9.	Law	9.					
10.	Other	10.					

Computer		?	O	L	M	H
1.	Social Science	1.				
2.	Humanities	2.				
3.	Physical and biological sciences	3.				
4.	Computer science	4.				
5.	Math	5.				
6.	Business	6.				
7.	Engineering	7.				
8.	Medicine	8.				
9.	Law	9.				
10.	Other 10.__					

C. Does your institution use video, audio or computer technologies to delivery specially-targeted instruction to any of the following special populations on or off campus? (Mark all that apply.)

		ON	OFF
1.	Professional - white collar	1. ___	___
2.	Workers - blue/pink collar	2. ___	___
3.	Hanicapped or homebound	3. ___	___
4.	Older adult (age 55 plus)	4. ___	___
5.	Rural adults	5. ___	___
6.	High school dropouts	6. ___	___
7.	Incarcerated	7. ___	___
8.	Women	8. ___	___
9.	Blacks	9. ___	___
10.	Hispanics	10. ___	___
11.	American Indians	11. ___	___
12.	Eskimo	12. ___	___
13.	Asian-Americans	13. ___	___
14.	Other 14. ___		

D. What types of communities does your institution serve via information technologies? (Mark all that apply.)

1.	Central City	1. ____
2.	Suburbs (close in)	2. ____
3.	Suburbs (distant)	3. ____
4.	Metropolitan area	4. ____
5.	Small city	5. ____
6.	Rural (non-farm)	6. ____
7.	Rural (farm)	7. ____
8.	Don't know	8. ____
9.	Other 9. ____	

E. Approximately what percentage of the learners served by your institution each year make use of video, audio or computer technologies in their instructional programs? (Mark one percentage for each technology: ? = don't know, 0 = none.)

		Percent							
		?	None	1-10	11-20	21-30	31-40	41-50	50+
1.	Video	___	___	___	___	___	___	___	___
2.	Audio	___	___	___	___	___	___	___	___
3.	Computer	___	___	___	___	___	___	___	___

F. Approximately how many enrollments do you have in video and audio telecourses per year? (Mark the number for each type.)

		0	1-50	51-100	101-250	251-500	501-1000	1001-2000	2001-5000	Over 5000
1.	Video	___	___	___	___	___	___	___	___	___
2.	Audio	___	___	___	___	___	___	___	___	___

G. Approximately what percentage of faculty at your institution develop any of the following types of courseware for use in their own courses (not necessarily for use by other faculty)?

		Percent						
		?	None	1-5	6-10	11-15	15-20	20+
1.	Video telecourses or segments	___	___	___	___	___	___	___
2.	Audio telecourses or segments	___	___	___	___	___	___	___
3.	Computer software	___	___	___	___	___	___	___

H. Does your institution produce any of the following types of courseware for lease or purchase by other institutions? (Mark one for each type: ? = don't know).

			?	Yes	No
1.	Video telecourses or segments	1.	___	___	___
2.	Audio telecourses or segments	2.	___	___	___
3.	Computer software	3.	___	___	___
4.	Other ____	4.	___		

I. Approximately what percentage of your faculty members receive special orientation or training in the use of information technologies? (Mark one percentage: ? = don't know, 0 = none.)

		Percent							
		?	0	1-5	5-10	11-25	25-50	51-75	76-100
1.	Video telecourses	___	___	___	___	___	___	___	___
2.	Audio telecourses	___	___	___	___	___	___	___	___
3.	Computer software	___	___	___	___	___	___	___	___

J. Does your institution offer special incentives or rewards to encourage faculty to get involved in the use of information technologies for instruction? Please check all that apply.

			?	No	Yes
1.	Training workshops and seminars (on campus)	1.	___	___	___
2.	Training workshops and seminars (beyond the campus)	2.	___	___	___
3.	Easy access to computers by faculty	3.	___	___	___
4.	Easy access to video classrooms or studios	4.	___	___	___
5.	Purchase, loan, or gift programs to facilitate faculty acquisition of microcomputers	5.	___	___	___
6.	Release time for courseware development or adaptation	6.	___	___	___
7.	Technical support for faculty who use video and audio	7.	___	___	___
8.	Technical support for faculty who use computers	8.	___	___	___
9.	Promotion policies that reward technology use	9.	___	___	___
10.	Tenure policies that reward technology use who use video and audio	10.	___	___	___
11.	Other	11.	____		

K. Has your institution created any task forces or study groups to assess institutional policies and plans regarding information technologies?

1. Don't know ___ 2. No ___ 3. Yes ___

L. Have you produced any such reports (see question K) you are willing to share with colleagues at other institutions?

? ___ Yes ___ No ___

Report title(s): _____

_____

Contact person: Name _____

Telephone ( ) _____

4. Factors Affecting the Use of Information Technologies

A. There are many factors that can hinder efforts of an institution to more effectively utilize information technologies. To what extent are the following potential hinderances obstacles for your institution? (Mark one for each obstacle: ? = don't know, No = not an obstacle, Min = minor obstacle, Maj = major obstacle.)

		Obstacles			
		?	No	Min	Maj
1.	Inadequate information about current educational applications of information technologies by other colleges and universities 1.	___	___	___	___
2.	Lack of courseware available that meets the institution's academic needs and standards 2.	___	___	___	___
3.	Lack of capacity to deal with maintenance and repair of technical equipment 3.	___	___	___	___
4.	Lack of reliable evaluative information about available media courseware. 4.	___	___	___	___
5.	Faculty who are unsympathetic to the use of information technologies. 5.	___	___	___	___
6.	Inadequate rewards and incentives to encourage faculty to get involved with the technologies. 6.	___	___	___	___
7.	Administrators who are unsympathetic to the use of information technologies. 7.	___	___	___	___
8.	Inadequate financial resources to obtain necessary hardware and software. 8.	___	___	___	___
9.	Logistical complexities involved in supporting students in learning off-campus via technology. 9.	___	___	___	___
10.	Inadequate cooperation from public broadcasting agencies. 10.	___	___	___	___
11.	Inadequate cooperation from cable television companies. 11.	___	___	___	___
12.	Inadequate knowledge about information technology on the part of the state policymakers (e.g., legislators). 12.	___	___	___	___
13.	Inadequate advice and support from state policymakers. 13.	___	___	___	___
14.	Unwillingness of educational institutions in the area to cooperate with one another to use the technology. 14.	___	___	___	___
15.	Other 15. _____				

B. How important would it be to your institution if higher education policymakers in your state government took the following actions to facilitate more effective use of information technologies? (Mark one for each action: ? = don't know, No = not important, IM = important, VIM = very important.)

		Action			
		?	No	IM	VIM
1.	Improvements in funding formulas for enrollment in courses using information technologies.	1. ___	___	___	___
2.	Incentive programs to encourage greater faculty involvement in information technology.	2. ___	___	___	___
3.	Policies which encourage collaborative use of information technologies by numerous institutions.	3. ___	___	___	___
4.	Additional financial support for acquisition of information technology hardware and courseware.	4. ___	___	___	___
5.	Advocacy for the interests of institutions in their dealings with broadcasters, cable companies, vendors.	5. ___	___	___	___
6.	Other	6. ____			

C. How important would it be to your institution if your local or state public broadcasting agency took the following actions to facilitate more effective use of video and audio instruction? (Mark one for each action: ? = don't know, No = not important, IM = important, VIM = very important.)

		Action			
		?	No	IM	VIM
1.	Allocated more broadcast time for higher education programming.	1. ___	___	___	___
2.	Reduced the costs for educational use of airtime.	2. ___	___	___	___
3.	Increased the selection of courses from which educators could choose.	3. ___	___	___	___
4.	Gave educators greater input in course selection.	4. ___	___	___	___
5.	Increased incentives for collaboration among colleges and universities (e.g., group buys of telecourses).	5. ___	___	___	___

6.	Developed telecourse production projects in collaboration with colleges and universities.	6.	__	__	___ ___
7.	Provide additional means of distributing courseware (e.g., video cassette, video disk, cassette, etc.)	7.	__	__	___ ___
8.	Other	8.	____		

D. The organization conducting this survey would like to assist educational institutions in their efforts to cooperatively make more effective use of the technologies. How important to your institution are the following areas for potential collaboration? (Mark one for each action: ? = don't know, No = not important, IM = important, VIM = very important.)

			Action			
			?	No	IM	VIM
1.	Information sharing with other educators who are using information technologies.	1.	__	__	___	___
2.	Networking with colleagues at other institutions regarding applications of technology to specific educational problems (e.g., serving remote learners).	2.	__	__	___	___
3.	Networking with colleagues regarding experiences in acquiring and using hardware and courseware.	3.	__	__	___	___
4.	Orientation and training opportunities for faculty and staff.	4.	__	__	___	___
5.	Orientation and training for state-level educational policymakers.	5.	__	__	___	___
6.	Shared lease or purchase of video, audio or computer courseware.	6.	__	__	___	___
7.	Shared development of such courseware.	7.	__	__	___	___
8.	Shared use of existing locally-developed courseware.	8.	__	__	___	___
9.	Shared preview and evaluation of available courseware.	9.	__	__	___	___
10.	Other	10.	____			

5. Special Features and Plans

A. What are the most noteworthy or unique features about the ways your institution uses information technologies?

B. What problems (not indicated above) has your institution encountered in the process of using these technologies?

C. What future plans do you have for the use of information technologies at your institution? In the short-run and the long-run?

D. In what curriculum areas do you see the need for more courseware?

E. What are the names of any special programs at your institution that make extensive use of information technologies (e.g., College of the Air, Audio Outreach, Microcomputer Laboratory)?

F. What technologies would you like to have more information on?

G. Contact Person(s) for further inquiries:

Name _____
Title
Institution _____
Address _____
Telephone ( ) _____

Name _____
Title
Institution _____
Address _____
Telephone ( ) _____

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